Innovative Strategic Foresight analysis for Land-Sea Management

the Valencian Community case study

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INTRODUCTION

Land-Sea Interface
Complex and dynamic area, intersection of ecological and socio-economic phenomena within terrestrial and marine ecosystems.

Climate Change
Further compound the challenges of: LSI ecosystems, high exposed population, settlements, and economic activities

Co-development in integrated planning
Need to provide accessible tools to SHs and policymakers to address the complexity and implement sustainable planning measures

Strategic foresight analysis
Emerging methodology for the exploration of future changes, combining advanced data analysis technologies with the active SHs participation

STRATEGIC FORESIGHT ANALYSIS REVIEW

MAIN AIM to understand what is the state of the art of strategic foresight analysys for the land-sea interface management

DATA COLLECTION

Scopus

2 Queries: 206 + 98 papers

- Strategic foresight analysis
- Climate, Water, Biodiversity
- Horizon scanning, Megatrend, Scenario, Backcasting

MAIN OUTPUTS

- Foresight has **strong potential for LSI** long-term planning, despite current underuse and challenges
- Challenges and opportunities in **expanding tool variety** and integration
- **Climate change** is mostly addressed qualitatively, calling for stronger data-driven foresight approaches
- **Stakeholder engagement** enhances the legitimacy and effectiveness of foresight, but remains limited and challenging

METHODOLOGY

1. Horizon Scanning
- Experts questionnaire
- Experts interview
- SHs workshop: Climate Change pressures

2. Megatrend analysis
- Framework creation and data collection
- Pressures mapping

3. Scenario planning
- Cumulative Impact Assessment (CIA) calculation and analysis
- CIA Impact weights extrapolation with NLP and generative AI (MedImp-AI and MedWeight-AI

1. HORIZON SCANNING

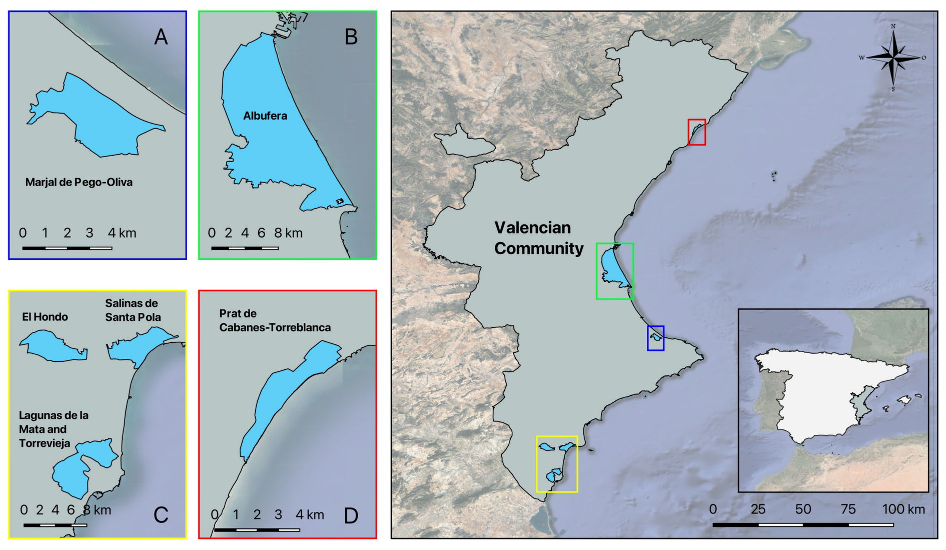
Bottom-up approach to gain an understanding of key pressures, most relevant sectors and spatial priorities within the case study.

Expert - based
- **Questionnaire**: overview
- **Interview**: insights

SHs - based
- **Workshop**: results were validated with SHs in Valencia where the impacts of climate change in the Valencian Community were deeper explored

MAIN CLIMATIC HAZARDS	MAIN ANTHROPOGENIC PRESSURES
Sea Level Rise Coastal Erosion Storm Surge Air Temperature Increase	Agricultural Activities Chemical contamination Land Anthropogenic Activities Urban development Tourism Offshore industries Marine transportation

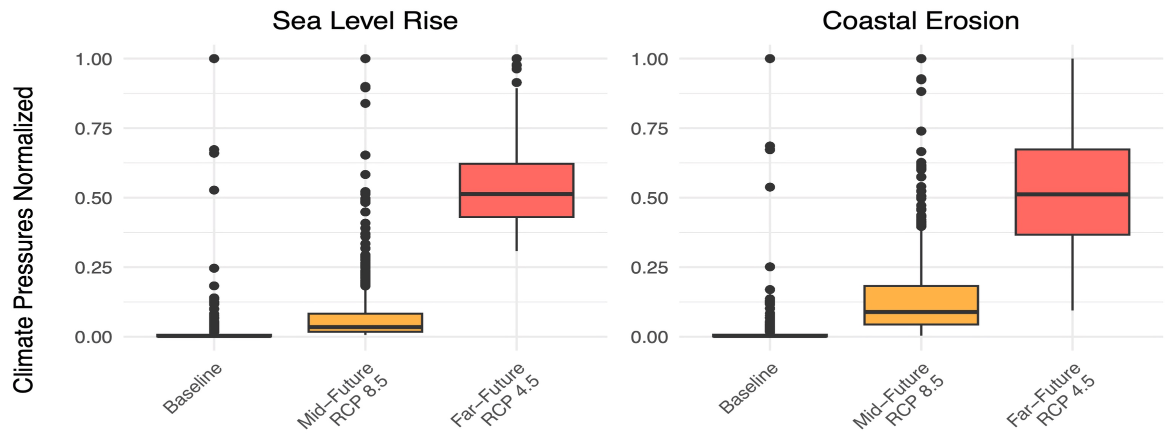
SPATIAL FOCUS The six coastal wetlands of the region



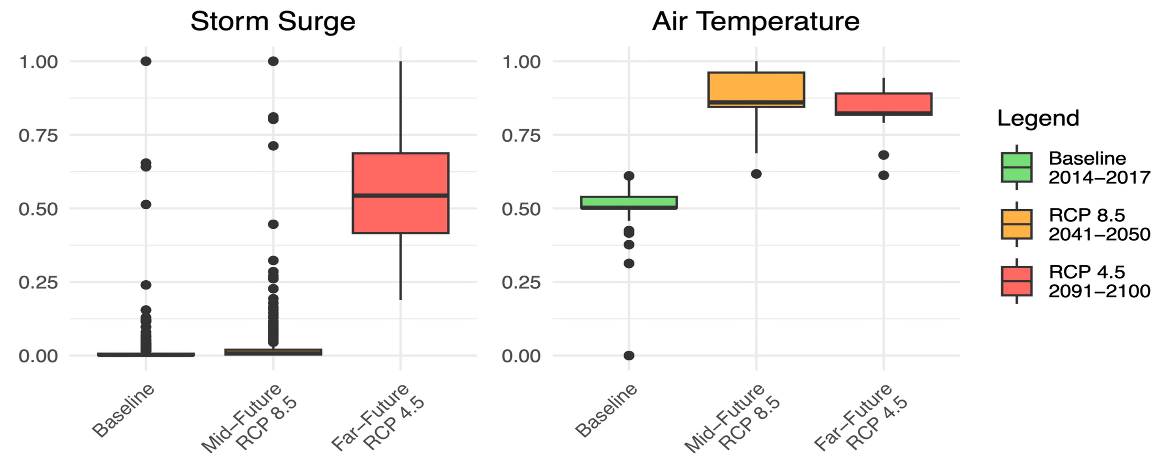
2. MEGATREND ANALYSIS

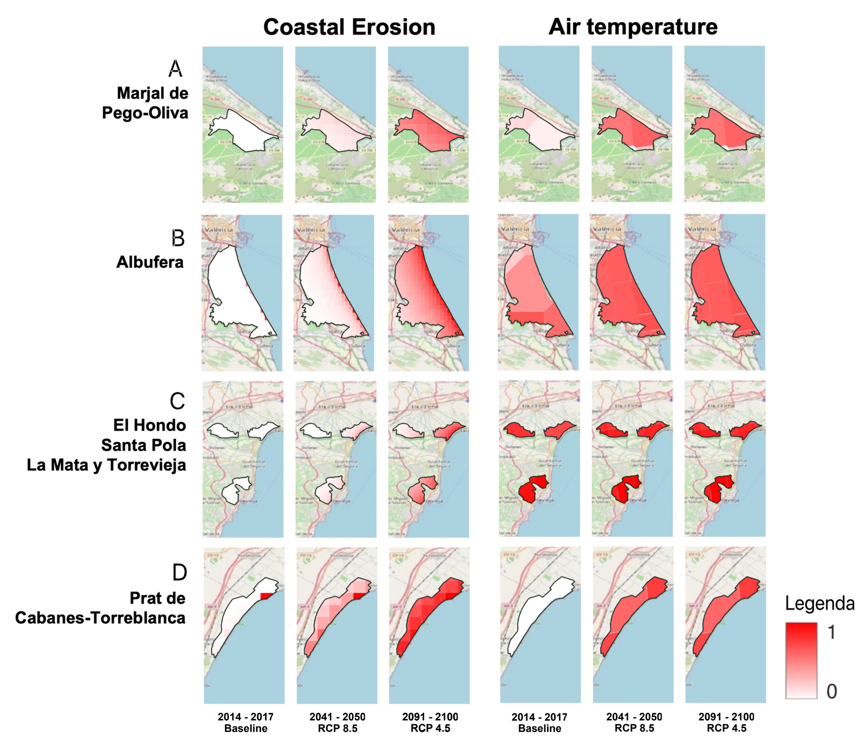
For each identified pressure, relevant indicators were selected from reliable sources (e.g. research institutes, local/international agencies). Climate hazards were analysed across three timeframes (**baseline, 2041–2050 RCP8.5, 2091–2100 RCP4.5**) using extreme monthly values.
All indicators were normalized and summed to produce pressure maps by location and timeframe.

Climate pressures normalized values across Scenarios



- **Sea Level Rise, Storm Surges, and Coastal Erosion** show similar trends with low pressure values in both the baseline and mid-future, followed by a marked increase in the far-future
- In contrast, **Air Temperature** low baseline values and the pick in the midterm under RCP8.5





3. SCENARIO PLANNING

The scenario planning phase was assessed through the implementation of a **CIA** based on Halpern (2008) approach

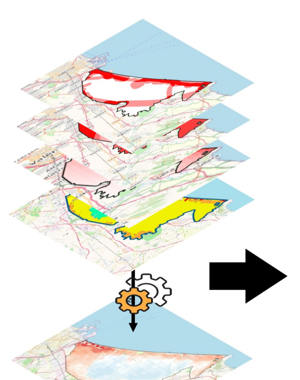
$$I_C = \sum_{i=1}^{n} \sum_{j=1}^{m} D_i * E_j * \mu_{i,j}$$

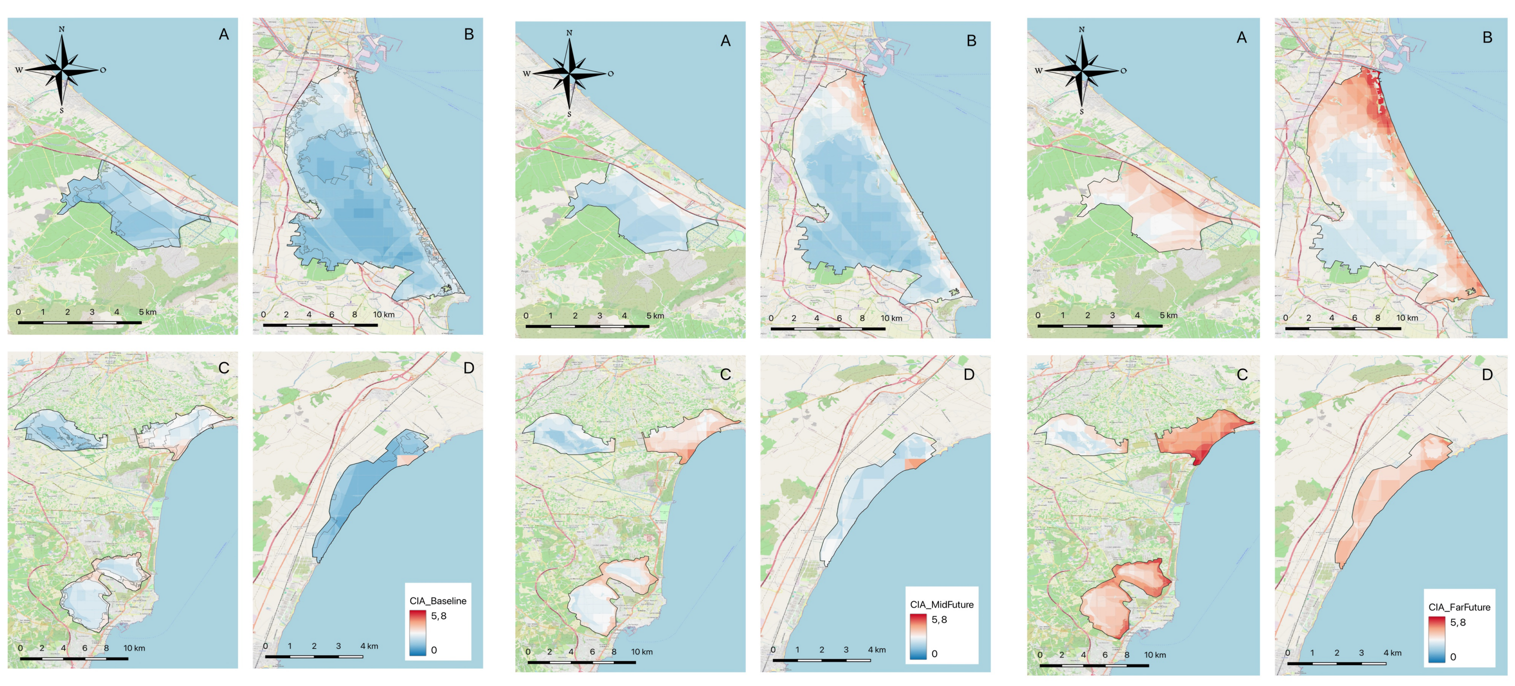
- D_i is the normalized value of a pressure at location i
- E_j is the presence or absence of ecosystem j
- $\mu_{i,j}$ is the impact weight for the pressure D and ecosystem j

NLP and Generative AI approach

- **Literature extraction**: 10354 papers. Query results based on keywords, abstract and title on Scopus
- **Paper selection**: 608 case studies. From journals and conference papers
- **MedImp-AI**: Generative transformer used to extract information about
  - Natural asset impacted
  - Corresponding CLC impacted
  - Pressure impacting
  - Pressure value
  - Impact value (normalized 0-1)
- **Matrix creation**: Pressures categorization and impact weights organization in a Pressure - CLC Matrix
- **MedWeight-AI**: Used to generate the missing values inside the matrix based on knowledge on similarities between different CLC classes

pressure class / CLC class	1.1 Urban areas	2.1 Arable land	2.2 Permanent crops	2.3 Pastures	2.4 Heterogeneous agricultural areas	3.1 Forests	3.2 Shrub and/or herbaceous vegetation associations	3.3 Open spaces with little or no vegetation	4.1 Inland wetlands	4.2 Coastal wetlands	5.1 Inland waters	5.2 Marine waters
Agricultural activities	**0,600**	0,659	0,672	0,686	0,687	0,693	0,691	**0,800**	**0,671**	0,651	**0,565**	**0,463**
Chemical contamination	0,681	0,681	0,681	0,682	0,682	0,683	0,685	**0,700**	**0,721**	0,681	**0,677**	**0,601**
Coastal erosion	**0,720**	0,682	0,675	0,670	0,665	0,660	0,653	**0,562**	0,655	**0,657**	**0,800**	**0,564**
Offshore industries	0,521	0,520	0,520	0,520	0,519	0,518	0,515	**0,460**	0,522	**0,592**	0,529	**0,527**
Land anthropogenic activities	0,613	0,614	0,614	0,615	0,616	0,618	0,620	0,625	**0,755**	**0,575**	**0,633**	**0,448**
Sea level rise	**0,900**	0,717	0,695	0,682	0,674	**0,725**	**0,716**	**0,630**	**0,400**	**0,580**	**0,474**	**0,703**
Maritime transportation	0,665	0,665	0,664	0,664	0,664	0,663	0,660	**0,600**	0,671	**0,800**	0,673	**0,600**
Storm surges	**0,612**	0,649	0,656	0,661	0,666	0,671	0,678	**0,748**	0,685	**0,767**	**0,700**	**0,492**
Air temperature	**0,421**	0,590	0,613	0,629	0,642	**0,654**	**0,800**	**0,700**	**0,666**	**0,800**	**0,508**	**0,551**
Tourism	**0,450**	0,497	0,504	0,508	0,511	**0,522**	**0,452**	**0,548**	**0,700**	**0,431**	0,515	**0,505**
Urban development	**0,634**	0,605	0,602	0,600	0,599	**0,700**	**0,436**	**0,519**	**0,668**	**0,600**	**0,579**	**0,632**

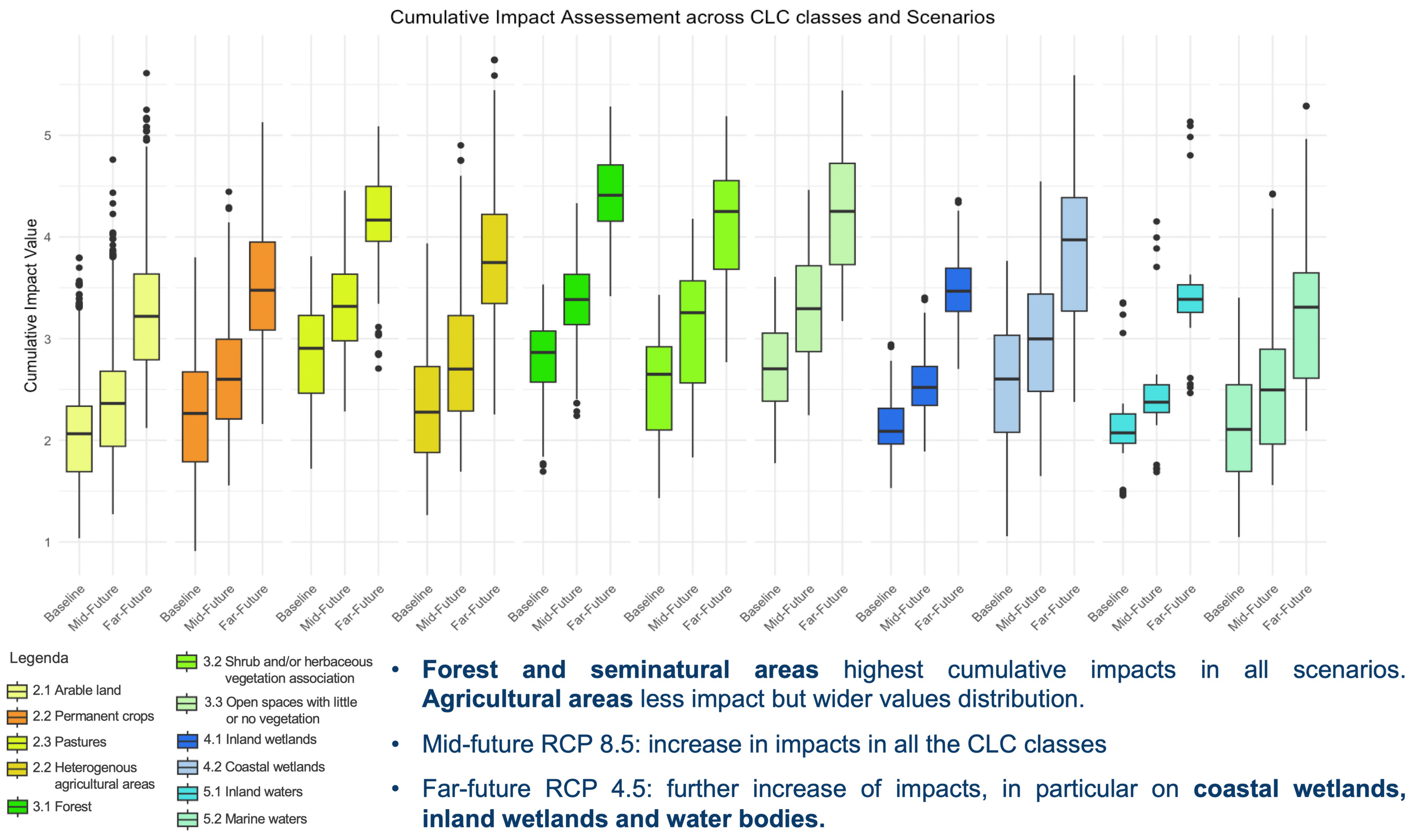




2014 – 2017 Baseline | 2041 – 2050 RCP 8.5 | 2091 – 2100 RCP 4.5

A progressive **increase of areas affected to more severe impacts in 2050 and 2100,** especially in Salinas de Santa Pola, North Albufera, and Lagunas de La Mata y Torrevieja.

Cumulative Impact Assessement across CLC classes and Scenarios



- **Forest and seminatural areas** highest cumulative impacts in all scenarios. **Agricultural areas** less impact but wider values distribution.
- Mid-future RCP 8.5: increase in impacts in all the CLC classes
- Far-future RCP 4.5: further increase of impacts, in particular on **coastal wetlands, inland wetlands and water bodies.**

KEY FINDINGS AND FUTURE RESEARCHES

- CIA on the Valencia wetlands shows higher impacts in the long-term (2100) impacts under RCP 4.5 scenario than in the mid-term (2050) under RCP 8.5 scenario
- Strategic foresight analysis was an effective methodology to combine diverging views, explore different possible future and build shared, actionable visions
- NLP and GenAI show strong potential to enhance and accelerate the CIA process
- A direct comparison between RCP 4.5 and 8.5 under the same time frame is needed to reach a better comparison, future researches should
- Climate data were normalized across scenarios while anthropogenic pressures were only for the baseline, next steps should integrate their evolution over time for consistency.
- Future research should address all phases of the strategic foresight cycle, exploring policy and desirable scenarios, leveraging collective intelligence to co-design compromise responses and support adaptive decision-making.

BlueGreen Governance on the One Ocean Science Congress

BlueGreen Governance is a Horizon Europe and the UK Research and Innovation funded project that aims to develop innovative land-sea governance schemes. Therewith the BlueGreen Governance project responds to the need for better-informed decision-making processes, social engagement and digital innovation while promoting more harmonious and effective science-policy-society interfaces in the context of ocean, marine and coastal governance.

The BlueGreen Governance project is presented in a series of posters.

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